

# *Centripetal Projectile* *Accelerator*

By:

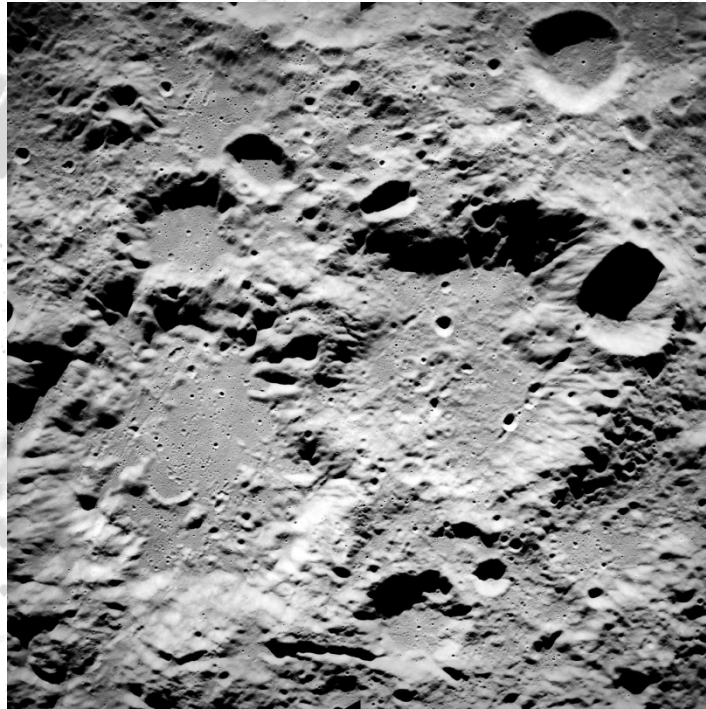
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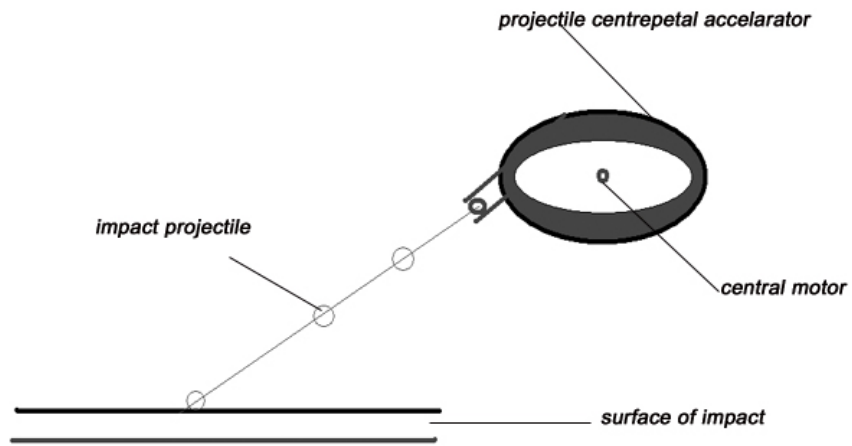
The surface of the moon is covered by the hard regolith. To penetrate this hard layer, it is necessary to beam the projectile with high velocities to the surface of the moon.



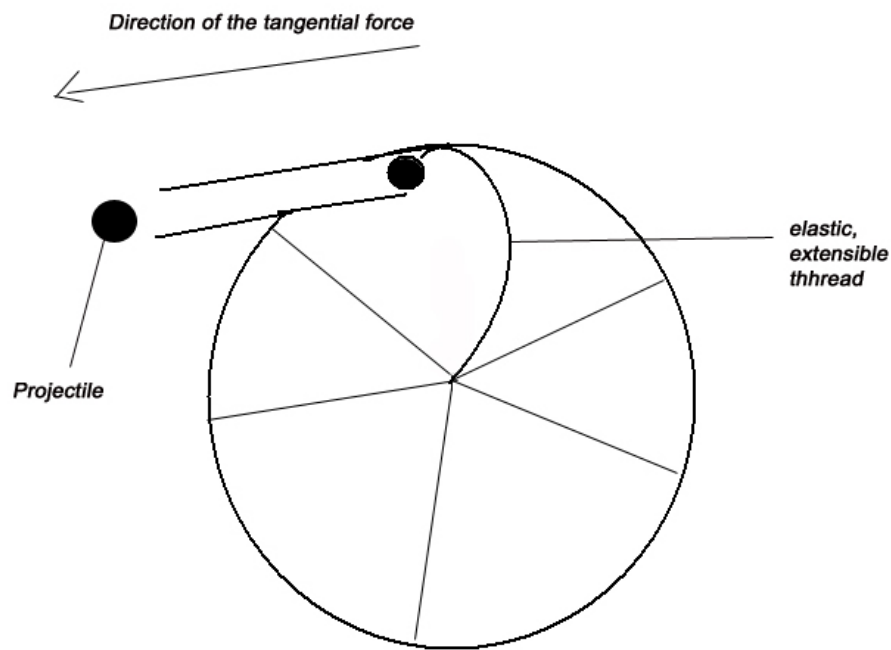
A picture of the surface of the moon

Keeping the above requirement in mind, the centripetal projectile accelerator has been designed.

The centripetal projectile accelerator is a circular structure which consists of an extensible string and the projectile attached to its end. The other end of the string has been connected to the electric motor. An outlet has been made tangentially to the outer structure to release the projectile.



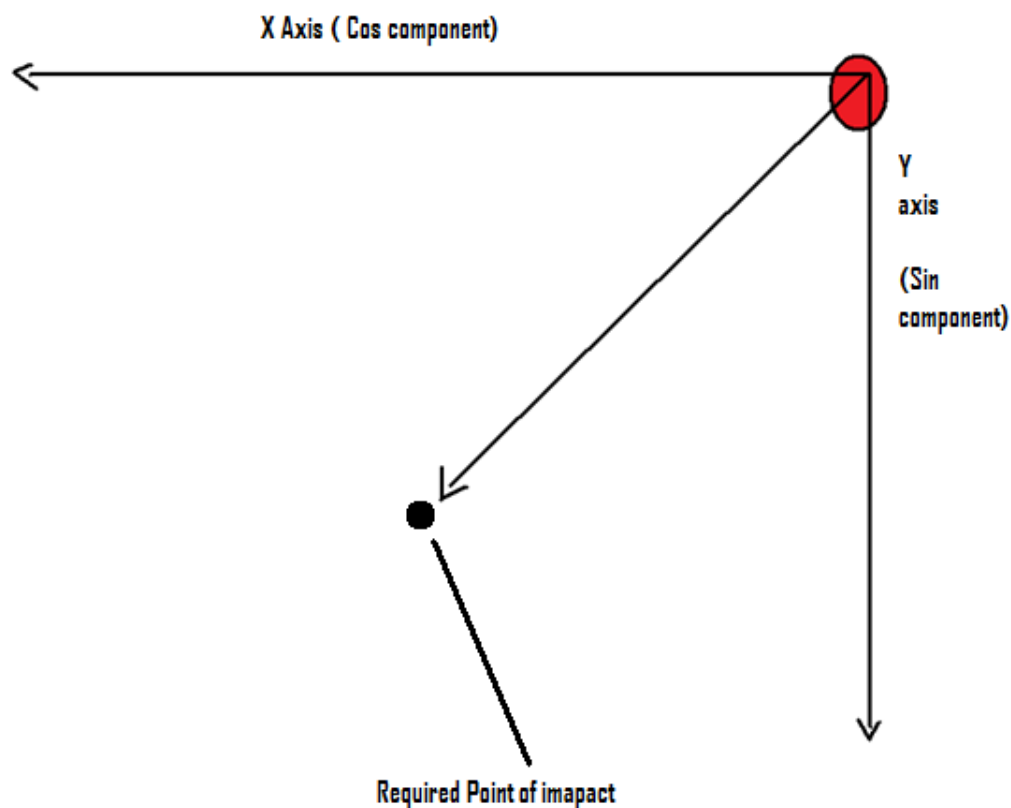
The above illustration represents the working of the centripetal projectile accelerator.



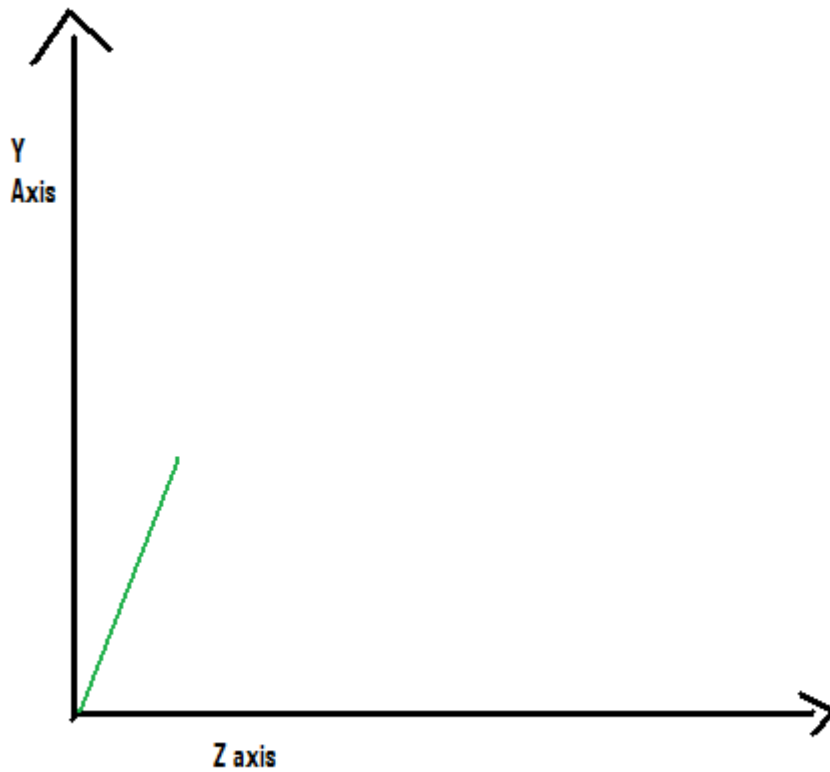
Internal representation of the centripetal projectile accelerator.

**Working:** At first, the extensible elastic string containing the projectile is attached to the motor. When the electric current is made to flow through the circuit, the motor begins to rotate. The string unwinds and starts to revolve under the influence of the centripetal force given by  $F = M V^2 / R$  and an acceleration of  $V^2 / R$  where  $M$  is the mass of the projectile,  $V$  is its velocity and  $R$  is the length of the string. The increase in the power of the motor would increase the acceleration further, till the string containing the projectile touches the internal surface of the accelerator. When the projectile reaches the desirable velocity, and the centripetal projectile accelerator aligns with the launch angle, it is detached from the string released through the tube. The projectile travels in straight line through the tangential component of the centripetal projectile accelerator as shown in the above image.

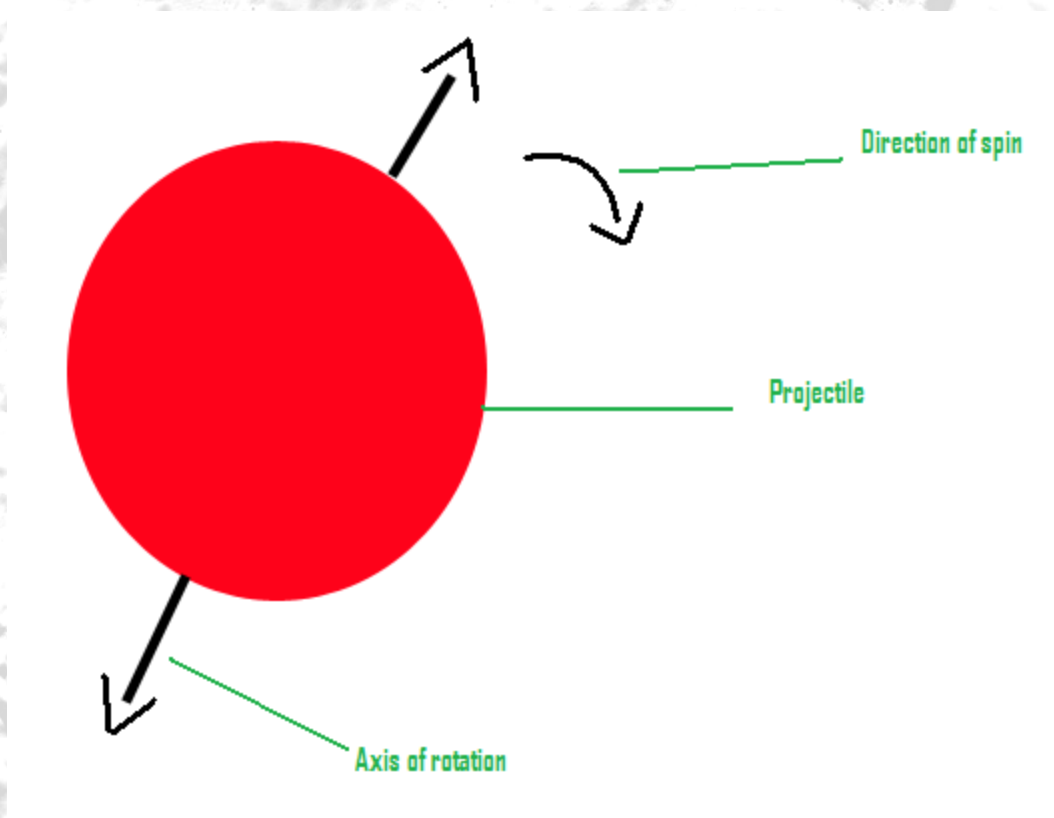
From the above design, the problem of the mechanism for impact is resolved. But there are still certain practical issues that need to be addressed. The First among which is the required launch angle. According to the laws of classical mechanics the projectile with the launch angle of 45 degrees with the horizontal has the maximum range. Incorporating this principle in the above situation, It implies that that centripetal accelerator aligned at an angle of 45 degrees can impact the regolith with maximum power. This fact is illustrated in the above diagram.



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The next idea that we consider is to increasing the results of the impact without creating the unnecessary heat that might destroy the scientifically important evidence. This can be done by laterally changing the position of the accelerator due to which a lateral angle of impact is achieved. This is illustrated in the above diagram.



Another important factor that tends to de stabilize the projectile during flight would be the tangential velocity that it might have achieved during launch. This tends to alter the path of the projectile and thereby missing the required sight of impact. To resolve this problem, I plan to use spin stability to stabilize the path of the projectile. To achieve the spin of the projectile, the centripetal projectile accelerator is lined with several rounds of copper conductor. An electric flow is created in the conductor by creating a potential difference across its ends. The projectile is made with a magnet. According to the Fleming's Left hand rule the revolution of the projectile it experiences a mechanical fore due to which it rotates about its axis at the tie of launch the projectile would spin about its own ais as shown in the above diagram and stabilize its path of impact.

This final design is in continuation with the preliminary design.

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